ACCOUNTING FOR EMISSIONS FROM AGRICULTURE, FORESTRY, AND OTHER LAND USE ACTIVITIES

2014

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PRESENTATION OVERVIEW

1. Introduction to climate change and emissions from land use sector
2. Basic approach to calculating emissions from land use change
3. International climate negotiations and accounting standards
4. IPCC Tiers
5. Rationale for developing the AFOLU Carbon Calculator

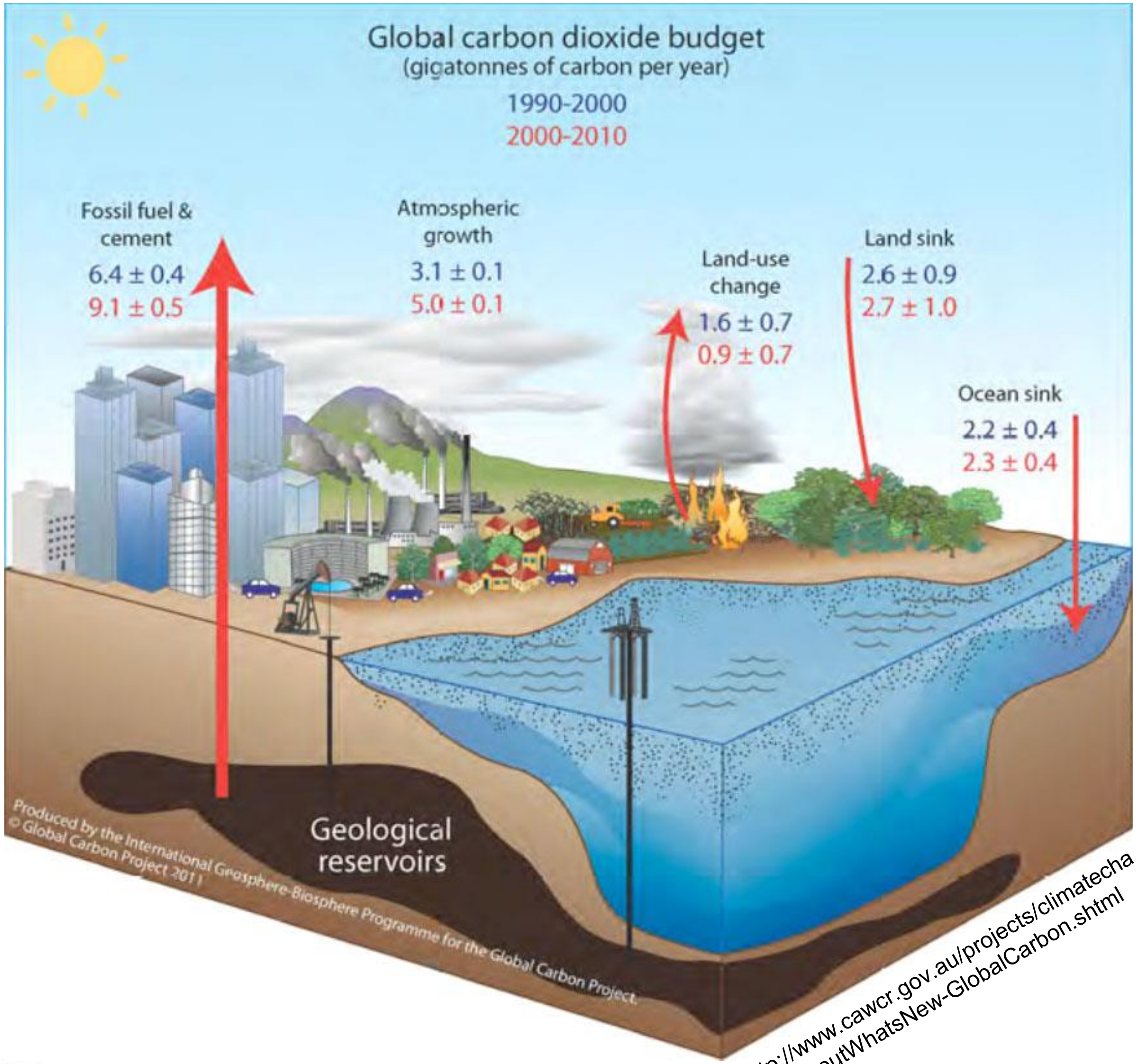
LAND USE AND CLIMATE CHANGE

Carbon is emitted to the atmosphere when:

- Forests are cleared or disturbed
  e.g. Fire, logging
- Soils are disturbed
  e.g. tilling croplands, draining peat soils
- Fossil fuel use

Carbon is removed from the atmosphere through:

- Photosynthesis
- Creation and burial of hydrocarbons and coal
- Ocean absorption



http://www.cawcr.gov.au/projects/climatechange/aboutWhatsNew-GlobalCarbon.shtml

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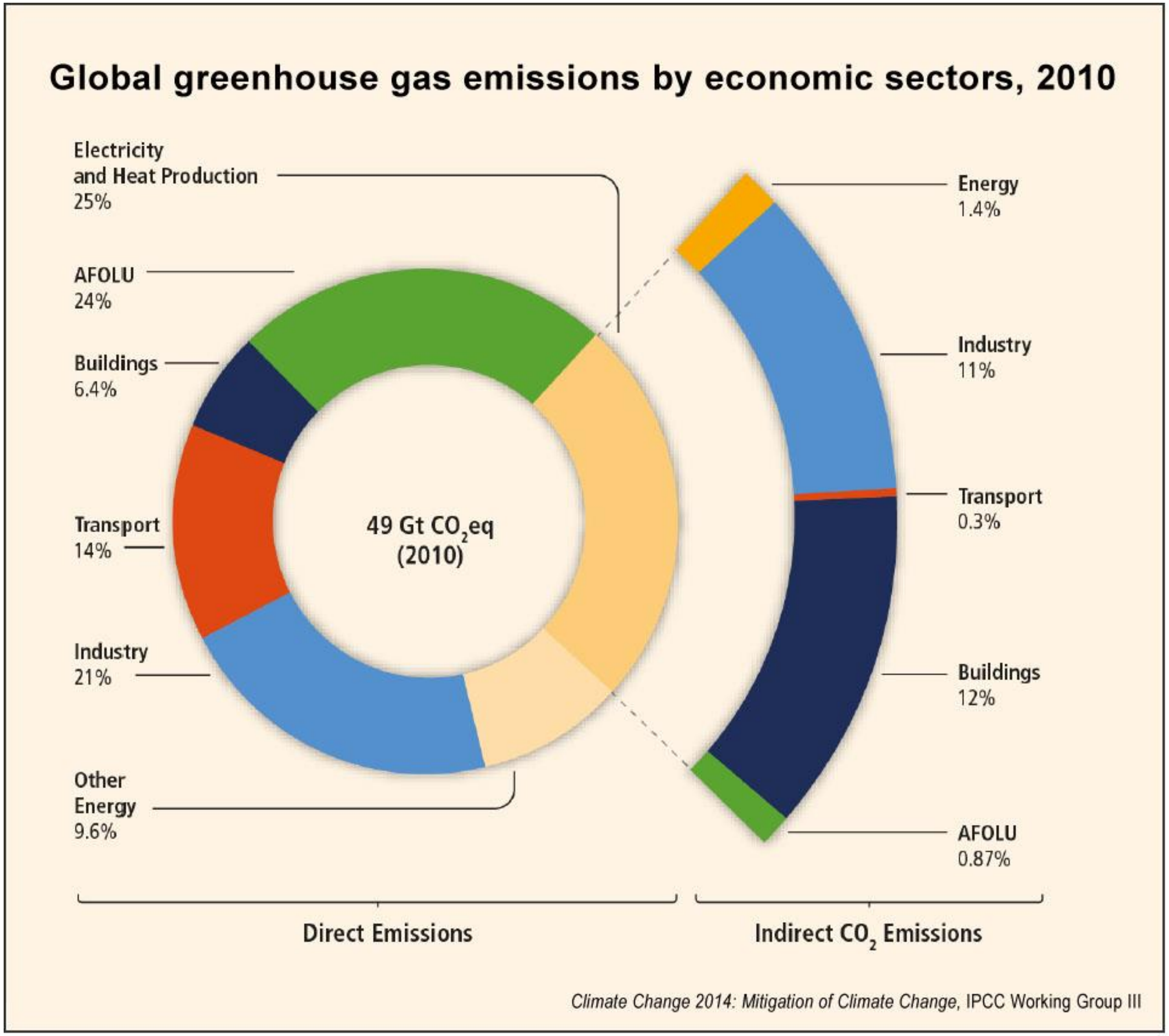
EMISSIONS FROM LAND USE AND LAND USE CHANGE



Tropical deforestation ~10% of GHG emissions (Harris et al., 2012).

However, mitigating emissions from forest loss is relatively quick, and inexpensive in stabilizing and reducing CO_2 emissions. (Parrotta et al., 2012)

Mitigating climate change: land use activities

Reducing deforestation and forest degradation

- Forest conservation
- Fire management
- Combatting illegal logging
- Improving timber harvesting practices
- Improving efficiency of fuelwood and charcoal usage in rural and urban centers

Increasing forest cover and productivity

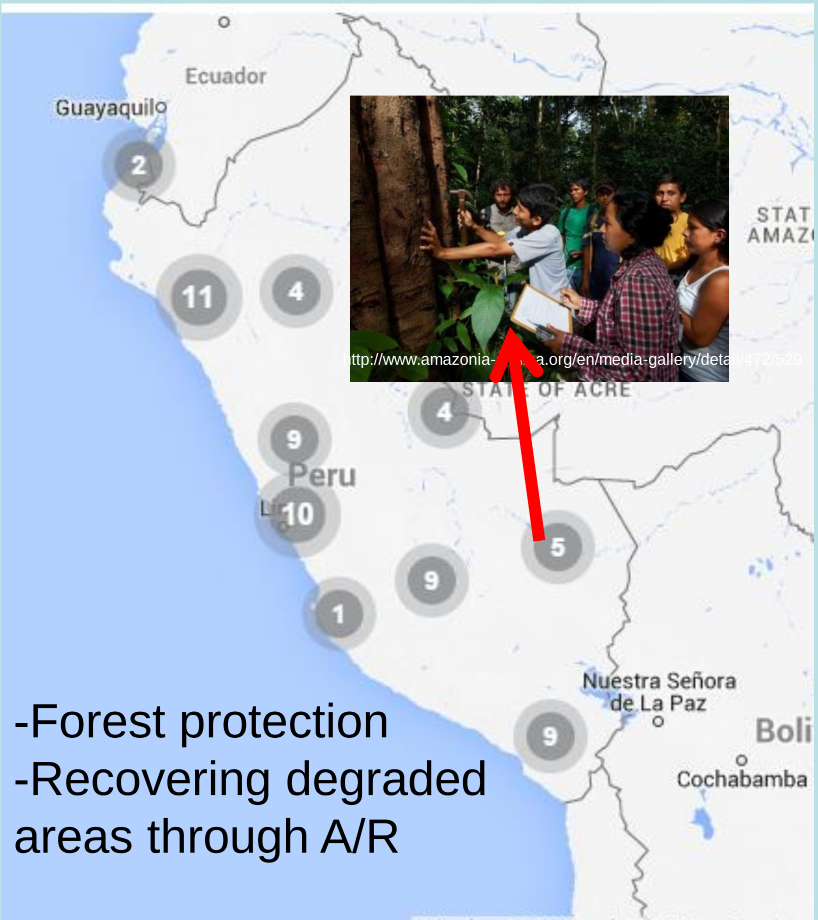
- Forest restoration
- Agroforestry
- Afforestation/Reforestation
  - Homogeneous stands
  - Heterogeneous stands

Climate-Smart Agriculture and Land Management

- Adopting practices that increase productivity, resilience, and reduce/remove GHGs:
  - Reduced tilling to lower CO_2 emissions from disturbed soil
  - Promoting permanent crops to reduce emissions from slash and burn farming
  - Reduced fertilizer inputs to reduce runoff and N_2O emissions
  - Livestock management to mitigate enteric fermentation and CH_4 emissions
  - Improved production efficiency

SO HOW TO ACCOUNT FOR CO_2 BENEFITS FROM AFOLU PROJECTS?

Peru: The Initiative for Conservation in the Andean Amazon – Madre de Dios



-Forest protection
-Recovering degraded areas through A/R

Colombia: BIOREDD

-14 REDD+ Projects totaling over 1 million ha
-agricultural intensification
-ecological restoration through A/R
-Sustainable forest and land use management

BASIC APPROACH FOR CALCULATING EMISSIONS/REMOVALS

Activity Data **X** **Emission/Removal Factors**

"*Data on the magnitude of human activity… taking place during a given period of time*" – IPCC

- Deforestation rate
- Area planted with native species
- Volume of timber extracted
- Number of animals raised
- Fertilizer input to crop lands

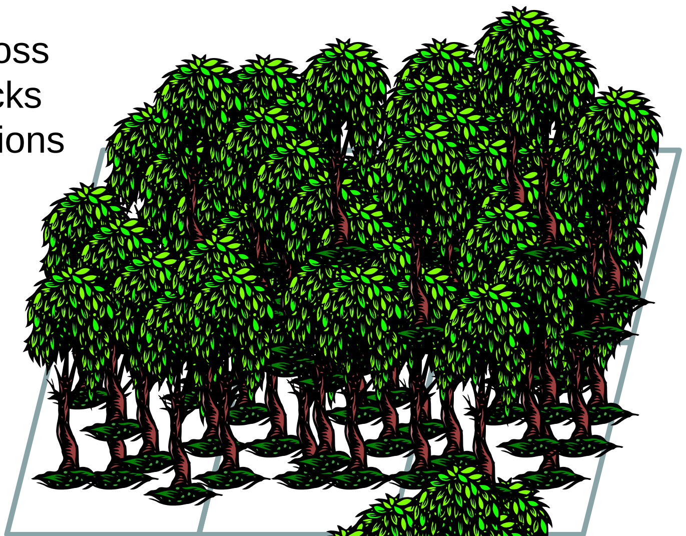
"The average emission rate of a given greenhouse gas… relative to units of activity" – IPCC

- Carbon stocks of cleared forests
- Carbon accumulation rate of native forests
- Dead wood created to extract a cubic meter of timber
- Volatilization/Oxidation rate of fertilizers

HOW ARE CO_2 BENEFITS CALCULATED?

Activity Data: Which changes occurred? Which changes would have occurred in the absence of the project? Where? On how many hectares?

High area loss
High C stocks
High emissions

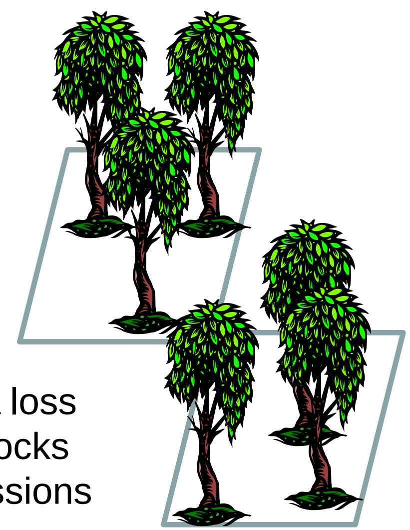


Low area loss
High C stocks
Intermediate to High Emissions

Emission/Removal Factors: How much carbon was emitted/removed per unit of area change? How much carbon would have been emitted/removed per unit area of change?

High area loss
Low C stocks
Low to intermediate emissions

Low area loss
Low C stocks
Low emissions



HOW DO I DEVELOP EMISSION FACTORS AND ACTIVITY DATA?

INT'L CLIMATE NEGOTIATIONS AND ACCOUNTING STANDARDS

United Nations
Framework Convention on Climate Change

International environmental treaty with the objective to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."

ipcc

Intergovernmental Panel on Climate Change – UNFCCC's scientific, technical, and socio-economic body that advises the UN on climate change assessment and mitigation.

ACCOUNTING FOR LAND USE EMISSIONS

2003: **Good Practice Guidance for Land use, Land-Use Change and Forestry (GPG-LULUCF)** produced by IPCC

2003: Parties agreed that Annex I Parties should use the GPG-LULUCF for preparing their GHG inventories in national communications under the UNFCCC. Non-Annex I Parties encouraged to use it.

2006: IPCC Guidelines for National Greenhouse Inventories, **Volume 4 'Agriculture, Forestry, and Other Land Use (AFOLU)'** replace GPG-LULUCF as the standard guidelines

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IPCC 'TIERS'

Three methodological tiers representing different levels of complexity.

Tier 1: Basic method. Uses default values for broad continental default values provided in LULUCF and AFOLU guidelines. Large uncertainties.

Tier 2: Approach using country-specific data (e.g. from field measurements). Smaller uncertainties.

Tier 3: Approach using data at a finer resolution or detailed modeling (e.g. comprehensive field sampling repeated at regular time intervals, soils data, and use of locally calibrated models)

EXAMPLES OF ACTIVITY DATA AND EMISSION FACTORS

Approach for activity data: Area change	**Tiers for emission factors: change in C stocks**
1. Non-spatial country statistics (e.g. FAO) — generally gives net change in forest area	1. IPCC default values at a continental scale-high uncertainty
2. Based on maps, surveys, and other national statistical data	2. Country specific data for key factors—medium to low uncertainty
3. Spatially specific data from interpretation of remote sensing data-only approach to use for deforestation and degradation	3. National inventory of key carbon stocks, repeated measurements or modeling — medium to low uncertainty

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EXAMPLE OF TIER 1 DATA

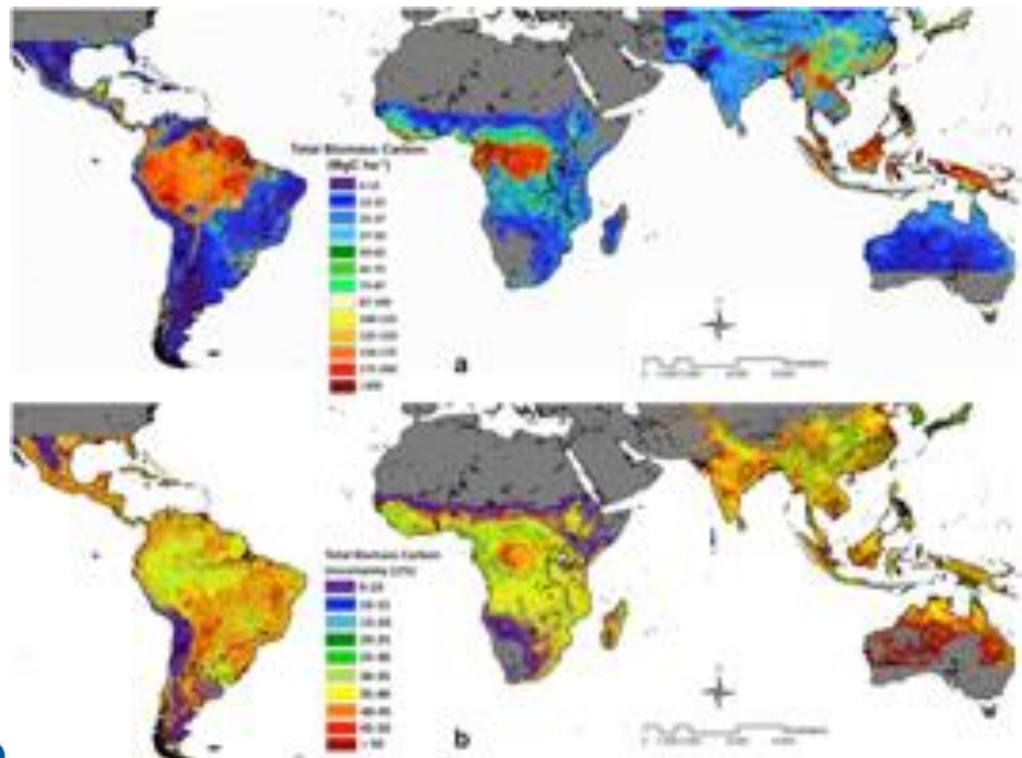
From IPCC Guidelines for National Greenhouse Inventories, **Volume 4 'Agriculture, Forestry, and Other Land Use (AFOLU)'**

TABLE 4.12
TIER 1 ESTIMATED BIOMASS VALUES FROM TABLES 4.7–4.11 (EXCEPT TABLE 4.11B)
(VALUES ARE APPROXIMATE. USE ONLY FOR TIER 1)

Climate Domain	Ecological Zone	Aboveground biomass in natural forests (tonnes dry matter ha^{-1})	Aboveground biomass in forest plantations (tonnes dry matter ha^{-1})	Aboveground net biomass growth in natural forests (tonnes dry matter ha^{-1} y^{-1})	Aboveground net biomass growth in forest plantations (tonnes dry matter ha^{-1} y^{-1})
Tropical	Tropical rain forest	300	150	7	15
	Tropical moist deciduous forest	180	120	5	10
	Tropical dry forest	130	60	2.4	8
	Tropical shrubland	70	30	1	5
	Tropical mountain systems	140	90	1	5
Sub tropical	Subtropical humid forest	220	140	5	10
	Subtropical dry forest	130	60	2.4	8
	Subtropical steppe	70	30	1	5
	Subtropical mountain systems	140	90	1	5
Temperate	Temperate oceanic forest	180	160	4.4	4.4
	Temperate continental forest	120	100	4	4
	Temperate mountain systems	100	100	3	3
Boreal	Boreal coniferous forest	50	40	1	1
	Boreal tundra woodland	15	15	0.4	0.4
	Boreal mountain systems	30	30	1	1

EXAMPLE OF TIER 2 DATA

Saatchi, SS, Harris, NL, Brown, S, Lefsky, M, Mitchard, ETA, Salas, W, Zutta, BR, Buermann, W, Lewis, SL, Hagen, S, Petrova, S, White, L, Silman, M & Morel, A 2011, "Benchmark map of forest carbon stocks in tropical regions across three continents" Proceedings of the National Academy of Sciences of the United States of America - PNAS, vol 108, no. 24, pp. 9899-9904., 10.1073/pnas.1019576108



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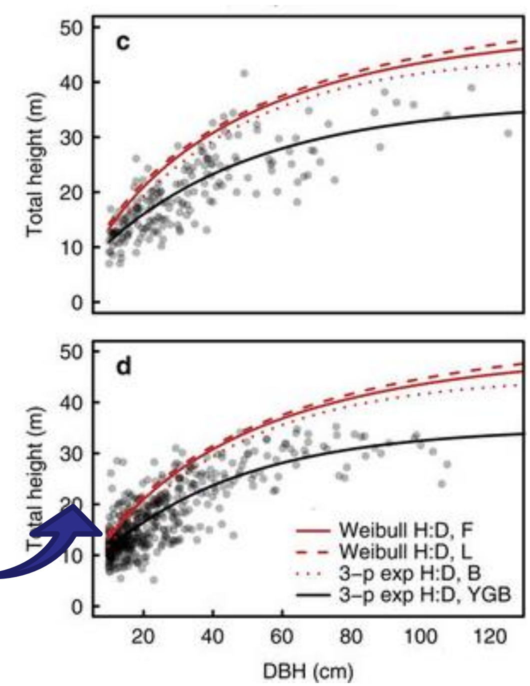
EXAMPLE OF TIER 3 DATA

- Measurements of carbon pools are recorded in the field
- Models and conversion factors are used to estimate carbon stocks in each major pool based on field measurements
- Statistical analysis is used to calculate average forest carbon stocks based on plot data



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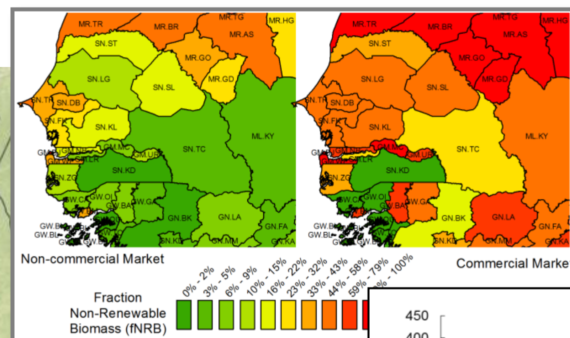
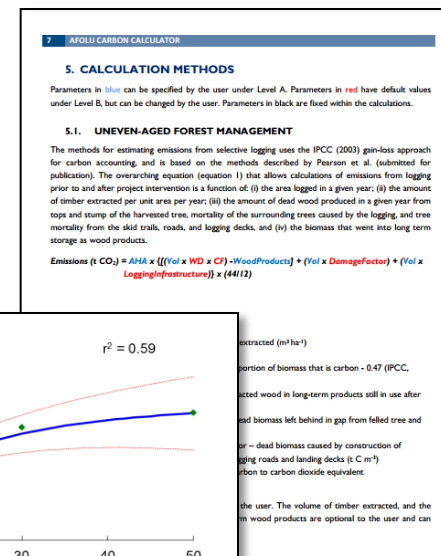
AFOLU CARBON CALCULATOR

- Employs IPCC approaches and data – or better!
- Much of default data is IPCC tier 2
  - Allows user to enter site-specific data
- Subnational unit resolution of data – allows for finer resolution estimates
- Methods and data peer reviewed and transparently documented

Navigate the map and click to select Subnational unit relevant to your interests




7 AFOLU CARBON CALCULATOR

5. CALCULATION METHODS

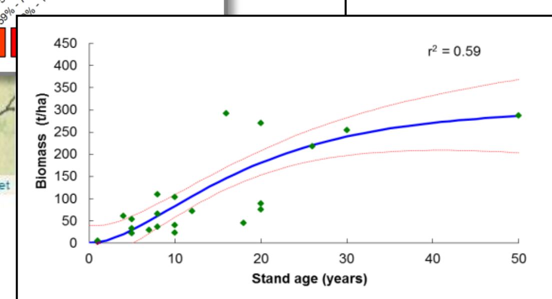
Parameters in blue can be specified by the user under Level A. Parameters in red have default values under Level B, but can be changed by the user. Parameters in black are fixed within the calculations.

5.1. UNEVEN-AGED FOREST MANAGEMENT

The methods for estimating emissions from selective logging uses the IPCC (2003) gain-loss approach for carbon accounting, and is based on the methods described by Pearson et al. (submitted for publication). The overarching equation (equation 1) that allows calculations of emissions from logging prior to and after project intervention is a function of: (i) the area logged in a given year; (ii) the amount of timber extracted per unit area per year; (iii) the amount of dead wood produced in a given year from tops and stump of the harvested tree, mortality of the surrounding trees caused by the logging, and tree mortality from the skid trails, roads, and logging decks, and (iv) the biomass that went into long term storage as wood products.

Emissions (t CO_2) = AHA x {[(Vol x WD x CF) -WoodProducts] + (Vol x DamageFactor) + (Vol x LoggingInfrastructure)} x (44/12)

extracted (m^3 ha^{-1})
portion of biomass that is carbon - 0.47 (IPCC,
cted wood in long-term products still in use after
ad biomass left behind in gap from felled tree and
r – dead biomass caused by construction of
ging roads and landing decks (t C m^{-3})
rbon to carbon dioxide equivalent
the user. The volume of timber extracted, and the
n wood products are optional to the user and can



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THANK YOU!

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